Smokers' Misperceptions of Light and Ultra-Light Cigarettes May Keep Them Smoking

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Introduction: This study examined smokers' understanding of the relative tar deliveries of Ultra-light, Light, and Regular cigarettes, reasons for smoking Ultra-light/Light cigarettes, and the likelihood of both quitting smoking and switching to Regular cigarettes if they came to learn that one Ultra-light/Light cigarette gave the same amount of tar as one Regular cigarette.

Design: Ten- to fifteen-minute random-digit-dialed, computer-assisted telephone interviews (CATI) were conducted with both a national probability sample (n = 788) and a state random sample (n = 266) of daily smokers over the age of 18.

Results: Less than 10% of smokers in the national sample and only 14% of smokers in the state sample knew that one Light cigarette could give the same amount of tar as one Regular cigarette. Less than 10% of smokers in the state sample knew that one Ultra-light cigarette could give the same amount of tar as one Regular cigarette. Thirty-two percent of the Light and 26% of the Ultra-light smokers in the national sample, and 27% of Light and 25% of Ultra-light smokers in the state sample, said they would be likely to quit smoking if they learned one Light/Ultra-light equaled one Regular.

Conclusion: Many Light and Ultra-light smokers are smoking these cigarettes to reduce the risks of smoking and/or as a step toward quitting. However, these smokers are unaware that one Ultra-light/Light cigarette can give them the same amount of tar and nicotine as one Regular cigarette. Many of the Ultra-light/Light smokers sampled in this study stated that they would be likely to quit if they knew this information. Mistaken beliefs about low-yield brands are reducing intentions to quit smoking.

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"L ight" is a powerful word. Added to a food label, "light" sells to the diet conscious. Added to a cigarette brand name, "light" can be marketed to health-conscious smokers looking for products lower in tar, nicotine, and, ultimately, disease risk.[1] Though "light" foods are required by the government to contain appreciably fewer calories and less fat, there are no equivalent requirements applying to the "contents" and "labeling" of cigarettes.[2]

Experimental research has indicated that modern Light cigarettes (approximately 6–15 mg tar by the Federal Trade Commission [FTC] Method) and those Ultra-light cigarettes (1–5 mg tar by FTC Method) above 1 mg tar do not deliver substantially reduced levels of tar, nicotine, and carbon monoxide to smokers, compared to Regular, Full-Flavor cigarettes.[3–8] Light and Ultra-light cigarettes can be subject to full compensation for reduced yields due to changes in smoking behavior. Smokers can transform even the lowest tar cigarettes into much higher tar cigarettes by taking more puffs or larger puffs on a cigarette, or by blocking filter air dilution vents with their fingers or lips.[9–11]

In addition, previous epidemiologic research used to support the idea that lower tar cigarettes are less hazardous is not necessarily applicable to today's cigarettes. Regular cigarettes at present are delivering much lower standard tar yields than did unfiltered high-tar cigarettes of 40 years ago. Some of the observed cancer risk reductions from the use of "low-tar" cigarettes often derive from studies in which low tar was defined as less than 17.6 mg tar[12] (higher tar was ≥25.8 mg tar) or less than or equal to 17.6 mg tar[13] (higher tar was ≥25.7 mg tar), meaning that today's most popular Regulars would fall into the low-tar category. Parish and colleagues performed a major case-control

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study of nonfatal myocardial infarction using 14,000 cases and 32,000 controls in the United Kingdom: 11- and 16-mg tar cigarettes fell within the same medium tar category and showed no difference in plasma cotinine levels in smokers within this tar range.[14] In other words, many modern Lights and modern Regulars are so similar that they were included in the same category. Additionally, the epidemiologic literature does not support the conclusion that Light cigarettes reduce tar, nicotine, or even cancer risk more than do today's Regular cigarettes[15] because they are very similar cigarettes and because of compensatory smoking. Further, changes in inhalation practices with lower-tar cigarettes appear to be causing an epidemic of special types of lung cancer.[16]

It is important to understand what smokers understand about low-tar products. Cohen explored the extent to which smokers treated standard tar ratings as rankings or numbers that could indicate the precise relationships between two cigarettes (e.g., how many 1-mg tar cigarettes do you need to smoke to get the same amount of tar as one 10-mg tar cigarette), and found that most smokers did not interpret the tar numbers correctly.[17] It should be noted, however, that most smokers do not even know the standard tar yields of their cigarettes,[18] but in contrast most know with confidence whether they smoke Ultra-light, Light, or Regular brands of cigarettes.[19] Since smokers think of their tar yields in terms of these three broad categories, we expected that it would be more in keeping with smokers' working knowledge of tar yields, and have potentially greater clinical value, to explore knowledge of compensatory smoking by asking smokers how many Light cigarettes someone would have to smoke to get the same tar as from one Regular cigarette. The most accurate answer using whole numbers is one.

If low-yield cigarettes deter smoking cessation in health-concerned smokers because of the belief these cigarettes reduce tar and nicotine exposures, then, if these smokers learned that this belief was incorrect, they should increase their intentions to quit smoking. This notion was also explored by asking smokers about their reasons for smoking low-yield cigarettes and if they would be more likely to quit smoking if they learned that their low-yield cigarette gave them the same amount of tar and nicotine as a Regular cigarette.

Method
National Participants

Participants in the national survey were self-reported daily cigarette smokers 18 years of age and older living in the continental United States. Random-digit-dialing

telephone samples of smokers of Ultra-light (N = 218; 66 males, 152 females), Light (N = 360; 137 males, 223 females), and Regular (N = 210; 107 males, 103 females) cigarettes were obtained. The average age of participants was 47 ± 14 (SD) years for Ultra-light smokers, 40 ± 13 years for Light smokers, and 41 ± 15 years for Regular smokers. The Ultra-light smokers were significantly older than both the Light and Regular smokers ($P < .0001$.) Participants smoked 21 ± 11 cigarettes per day, 89% were Caucasian, and 87% had at least a high school degree.

State Participants

Participants in the state survey were self-reported daily smokers of Ultra-Light (n = 22; 5 men, 17 women), Light (n = 120; 45 men, 75 women), and Regular cigarettes (n = 124; 70 men, 54 women) living in Massachusetts. All participants were at least 18 years of age. The average age of participants was 51 ± 14 years for Ultra-light smokers, 40 ± 13 years for Light smokers, and 41 ± 14 years for Regular smokers. Again, the Ultra-light smokers were significantly older than both the Light and Regular smokers ($P < .001$). Participants smoked 19 ± 12 cigarettes per day, 92% were Caucasian, and 90% had at least a high school degree.

Procedures

Random-digit-dialing and computer-assisted telephone interviewing (CATI)[20] were used to conduct 10–15-minute interviews with a sample of daily cigarette smokers living in the continental United States (NATIONAL): Disproportionate sampling was done for smokers of Ultra-lights (more calls were made to locate more smokers of Ultra-light cigarettes), and the sample of Regular smokers was limited. The second survey was a random sample of daily smokers living in Massachusetts (STATE), with no disproportionate sampling to locate more smokers in any tar category. The survey focused on questions about the perception of Light and Ultra-light cigarettes. To select a person to interview within the household, we asked to speak to the person over 17 within the household who last had a birthday[21]; another household was called if that individual did not report both having smoked at least 100 cigarettes in their lifetime and currently smoking cigarettes on a daily basis. As many as twenty call-backs were made, achieving an overall response rate of 63% for the national sample and 83% for the state sample, both acceptable rates according to the Council of American Survey Research formula.[22] The cooperation rate (completed interviews/all contacted capable of being interviewed) was 73% for the national sample and 97% for the state sample.

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Key Questions

How many Lights/Ultra-lights equal one Regular. Smokers in both samples were asked: "How many LIGHT cigarettes would someone have to smoke to get the same amount of tar as from one REGULAR cigarette?" Given the relatively high percentage of respondents in the national sample who responded "don't know," we asked smokers in the state sample who initially answered "don't know" to make a guess about how many Lights equal one Regular. In addition, we asked the state sample how many Ultra-light cigarettes equal one Regular.

Reasons for smoking Light/Ultra-light cigarettes. Smokers of Ultra-light and Light cigarettes were asked only the following questions (ordered rotated): "Now I'm going to ask you about reasons some people might give for smoking [Light or Ultra-light, according to self-reported usual type] cigarettes. For each one please tell me whether it is one of your reasons for smoking [Light or Ultra-light] cigarettes. Do you smoke [Light or Ultra-light] cigarettes as a step toward quitting smoking completely?"; "Do you smoke [Light or Ultra-light] cigarettes to reduce the risks of smoking without having to give up smoking?"; "Do you smoke [Light or Ultra-light] cigarettes to reduce the tar you get from smoking?"; "Do you smoke [Light or Ultra-light] cigarettes to reduce the nicotine you get from smoking?"; "Do you smoke [Light or Ultra-light] cigarettes because you prefer the taste compared to Regular cigarettes?". If the response were yes to any of these reasons, smokers were asked: "How important is this reason to you? Is it very important or somewhat important?" (response categories included yes, very important; yes, somewhat important; no; don't know; or refused). Extensive pretesting using open-ended questions showed that these items captured the main reasons given by smokers for using Light and Ultra-light cigarettes.

Likelihood of quitting smoking and switching to a Regular cigarette if one Light (or Ultra-light) equals one Regular. Toward the end of the questionnaire, the following questions were asked of Ultra-light and Light smokers: "If you learned that [Light or Ultra-light] cigarettes gave you the same amount of tar and nicotine as a Regular cigarette, would that make you more likely to stop smoking? Would you say it would make you not very likely (1), somewhat likely (2), or very likely (3) to stop smoking?"; "If you learned that [Light or Ultra-light] cigarettes gave you the same amount of tar and nicotine as a Regular cigarette, would that make you more likely to switch to a Regular cigarette? Would you say it would make you not very likely (1), somewhat likely (2), or very likely (3) to switch to Regular cigarettes?"
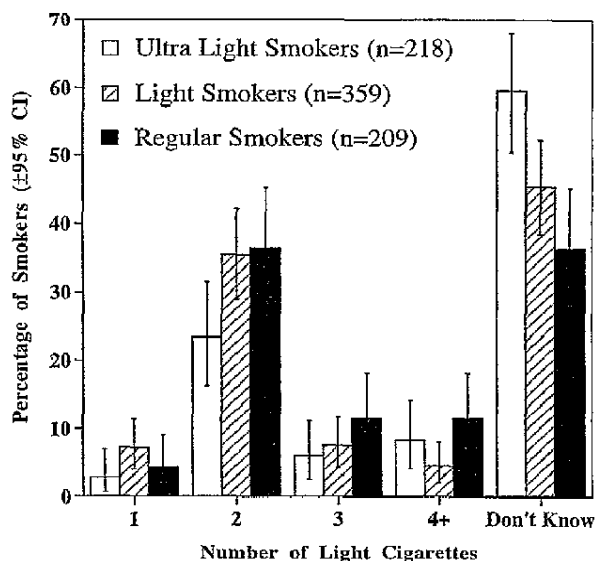

Figure 1. Smokers' perceptions of the number of Light cigarettes ($\pm95\%$ CI) someone would have to smoke to get the same amount of tar as from one Regular cigarette (national sample).

Data Analyses

Participants' responses to the key questions were calculated as percentages with 95% confidence intervals. Multiple logistic regression analyses were performed to identify predictors of increased intention to quit smoking if Lights (or Ultra-lights) gave the same amount of tar and nicotine as Regular cigarettes (not likely to quit = 0, somewhat or very likely to quit = 1). Several models were evaluated to control for such factors as age, gender, and heaviness of smoking. Brand category (Light, Ultra-light) was included to control for effects due to group membership, after determining that brand category did not interact with any other predictors in the model.

Results

How Many Lights/Ultra-lights Equal One Regular

National sample. Figure 1 graphs Ultra-light, Light, and Regular smokers' perception of how many Light cigarettes equal one Regular cigarette. Less than 10% of all smokers in this sample knew that one Light cigarette could give the same amount of tar as one Regular. The modal response was "don't know" (60% Ultra-light, 45% Light, and 36% Regular). The next most common response was 2 (23% Ultra-light, 35% Light, and 36% Regular).
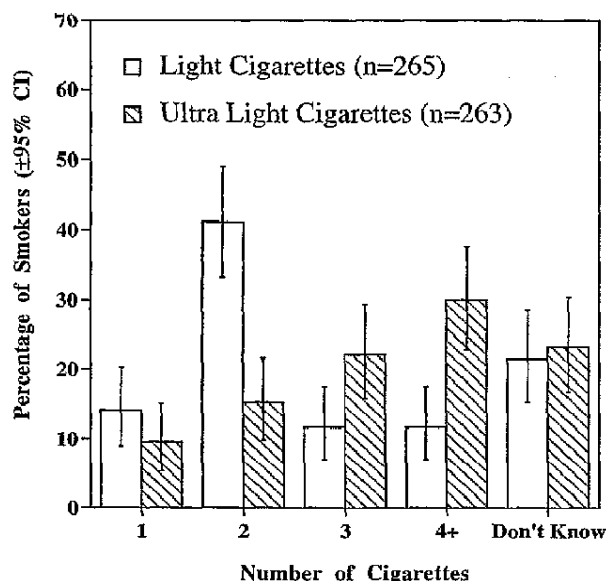
Figure 2. Smokers' perceptions of the number of Light and Ultra-light cigarettes (±95% CI) someone would have to smoke to get the same amount of tar as from one Regular cigarette (state sample).

State sample. Figure 2 shows both the number of Light and the number of Ultra-light cigarettes believed to equal one Regular cigarette for all three categories of smokers combined. Unlike the national sample, and probably due to asking respondents to "make a guess," the modal response for the number of Lights equaling one Regular was 2 (41%). Fourteen percent knew that one Light cigarette can give a smoker the same amount of tar as one Regular cigarette.

The modal response for the number of Ultra-light cigarettes it would take to equal one Regular cigarette in tar delivery was "4 or more" (30%). For those who gave numeric answers for both questions, the reported number of Ultra-lights equaling one Regular was on average higher than the reported number of Lights equaling one Regular (4.7 vs. 3.2, t (−7.2), $P < .0001$).

Reasons for Smoking Light/Ultra-light Cigarettes

National sample. Table 1 shows the percentage of respondents (National and State) who reported that the given reasons for smoking Ultra-light or Light cigarettes were at least "somewhat important" reasons for them. Among Ultra-light smokers, only 2% ± 2 (95% CI) responded "no" to all of the reasons listed in Table 1 and 18% ± 5 responded "yes" to all of the reasons. Among Light smokers, only 5% ± 2 responded "no" to all of the reasons and 13% ± 4 responded "yes" to all of the reasons. For 38% of the Ultra-light smokers and 19% of the Light smokers, reducing risks was a "very important" reason.

State sample. Among Ultra-light smokers, 0% responded "no" to all of the reasons listed in Table 1 and 23% ± 18 responded "yes" to all of the reasons. Among Light smokers, only 6% ± 4 responded "no" to all of the reasons and 14% ± 6 responded "yes" to all of the reasons. Fifty percent of Ultra-light smokers and 22% of the Light smokers stated that reducing risks was a "very important" reason.

Likelihood of Quitting Smoking and Switching to a Regular Cigarette If One Light (or Ultra-light) Equals One Regular

National sample. Table 2 indicates the percentage of Light and Ultra-light smokers (National and State) reporting an increased likelihood of quitting smoking if they learned that one Light (or Ultra-light) gave them the same amount of tar and nicotine as one Regular cigarette. Among Ultra-light smokers, one in three indicated that they would be at least somewhat likely to quit smoking if they learned that one Ultra-light is equivalent to one Regular cigarette. In the sample of Light smokers, one in four indicated that they would be at least somewhat likely to quit smoking if they learned that one Light cigarette is equivalent to one Regular cigarette.

Table 2 also shows the percentage of Light and Ultra-light smokers (National and State) reporting an increased likelihood of switching to a Regular cigarette

Table 1. Percentage of smokers who answered that the following were reasons for smoking Lights or Ultra-lights (% + 95% CI)				
	National sample		**State sample**	
Reason	**Ultra-lights (n = 218)**	**Lights (n = 360)**	**Ultra-lights (n = 22)**	**Lights (n = 120)**
Step to quitting	49 ± 7	30 ± 5	55 ± 21	43 ± 9
Less risk	58 ± 7	39 ± 5	59 ± 21	43 ± 9
Less tar	73 ± 6	57 ± 5	77 ± 18	65 ± 9
Less nicotine	72 ± 6	50 ± 5	64 ± 20	58 ± 9
Prefer taste	69 ± 6	80 ± 4	77 ± 18	73 + 8

Table 2. Reported likelihood of quitting smoking or switching to Regulars upon learning that one Light (or Ultra-light) equals one Regular (% + 95% CI)*

| | National sample | | State sample | |
	Ultra-light	Light	Ultra-light	Light
Likely to quit smoking	32 ± 6	26 ± 5	27 ± 19	25 ± 8
Likely to switch to Regulars	12 ± 4	9 ± 3	9 ± 12	11 ± 6

* None of the differences between Ultra-light and Lights smokers' responses was significant.

if they learned that one Light (or Ultra-light) gave them the same amount of tar and nicotine as one Regular cigarette. Only 12% of Ultra-light smokers and 9% of Light smokers in the National sample reported that they would be at least somewhat likely to switch to Regular cigarettes if they learned that Lights (or Ultra-lights) gave the same amount of tar and nicotine as Regular cigarettes.

State sample. One in four Ultra-light and Light smokers indicated that they would be at least somewhat likely to quit smoking if they learned that one Light (or Ultra-light) cigarette is equivalent to one Regular cigarette. Only 9% of Ultra-light smokers and 11% of Light smokers reported that they would be at least somewhat likely to switch to Regular cigarettes if they learned that Lights (or Ultra-lights) gave the same amount of tar and nicotine as Regular cigarettes.

Predictors of Increased Likelihood of Quitting Smoking If One Light Equals One Regular

National sample. Predictors of increased likelihood of quitting if Lights (or Ultra-lights) gave the same amount of tar and nicotine as Regular cigarettes (not likely to quit = 0, somewhat or very likely to quit = 1) were explored. Gender, age, education, and brand category were not significant predictors in multivariate models. Brand category did not interact with other predictors, and it was included in the model to control estimates for the effect of brand category.

Two additional dichotomous predictor variables were included in the model. The first variable was referred to as "step toward quitting." Those participants who reported that smoking Lights (or Ultra-lights) as a step toward quitting was either a somewhat important reason or very important reason for them were scored as one, and those who were not smoking Lights (or Ultra-lights) for this reason were scored as zero. The second variable, "risk reduction," was a composite variable that included the responses to three questions about reasons for smoking Light or Ultra-light cigarettes (i.e., reduce risks to health, reduce tar, and reduce nicotine). The intercorrelation among these three reasons for smoking Lights (or Ultra-lights) was high (alpha = .76). Including both Light and Ultra-light smokers, 26% reported none of the three reasons

(score = 0), 14% reported one of the three reasons (score = .33), 23% reported two of the three reasons (score = .66), and 37% reported all of the three reasons (score = 1). The mean score for the composite variable was .57.

The likelihood of quitting smoking upon learning that Lights (or Ultra-lights) give the same amount of tar and nicotine as Regular cigarettes was increased for participants who reported smoking Lights (or Ultra-lights) as a step toward quitting (beta = 1.20, $P < .0001$), and also to reduce tar, nicotine, and risks to health (i.e., composite variable; beta = .95, $P < .001$). For these same participants, the odds of quitting were 3.31 (95% CI = 2.16–5.08) and 2.58 (95% CI = 1.45–4.57) times greater, respectively.

Additional logistic regression analyses were done to examine the effect of each individual variable included in the composite variable "risk reduction." When controlling for the other two predictors in the model (brand category and step toward quitting), each individual variable from "risk reduction" was a significant predictor of increased likelihood of quitting smoking: reduce risks to health (odds ratio = 1.75, 95% CI = 1.16–2.66); reduce tar (odds ratio = 1.84, 95% CI = 1.15–2.93); reduce nicotine (odds ratio = 1.91, 95% CI = 1.22–3.00).

State sample. Gender, age, education, and brand category were not significant predictors in multivariate models of increased likelihood to quit smoking. Brand category did not interact with other predictors, and it was included in the model to control estimates for the effect of brand category.

Similar to the national sample, "step toward quitting" and a composite variable "risk reduction" were included in the model. The intercorrelation between the three "risk reduction" reasons for smoking Lights (or Ultra-lights) was high (alpha = .75). Including both Light and Ultra-light smokers, 27% reported none of the three reasons (score = 0), 11% reported one of the three reasons (score = .33), 27% reported two of the three reasons (score = .66), and 36% reported all of the three reasons (score = 1). The mean score for the composite variable was .60.

The likelihood of quitting smoking upon learning that Lights (or Ultra-lights) give the same amount of tar

and nicotine as Regular cigarettes was increased for participants who reported smoking Lights (or Ultra-lights) as a step toward quitting (beta = 1.17, $P < .01$), and also to reduce tar, nicotine, and risks to health (i.e., composite variable; beta = 1.58, $P < .01$). For these same participants, the odds of quitting were 3.22 (95% CI = 1.39–16.95) and 4.86 (95% CI = 1.34–7.77) times greater, respectively.

Logistic regression analyses were done to examine the effect of each individual variable included in the composite variable "risk reduction." When controlling for the other two predictors in the model (brand category and step toward quitting), both "reduce tar" (odds ratio = 3.42, 95% CI = 1.07–10.91) and "reduce nicotine" (odds ratio = 1.11, 95% CI = 1.13–8.17) were significant predictors of increased likelihood of quitting smoking. The variable "reduce risks to health," although in the right direction, was not a significant predictor (odds ratio = 2.09, 95% CI = .92–4.76).

Recoding answers on quit intentions had little effect on the results. To confirm that the main results were not due to a weaker subjective criterion (collapsing "somewhat" and "very" likely to quit), multiple logistic analyses were also run scoring "not at all" and "somewhat likely" as 0 and scoring "very likely" as 1. In every case, the substantive patterns of results using step toward quitting and the composite variable were reproduced in models with acceptable probability levels ($P < .05$), except for the composite variables on the likelihood of quitting for the State sample. This weaker finding may be the result of decreased variability in the dependent variable with the stricter criterion (only 11 people in this sample said they were "very likely" to quit).

Discussion

Our findings from two independent samples indicate that a significant number of smokers of Light and Ultra-light cigarettes are using these brands with expectations of lower tar and nicotine exposures. This is supported by the widespread overestimation of the number of Light cigarettes necessary to equal one Regular cigarette in tar delivery: less than 10% of smokers in the National sample and only 14% of smokers in the State sample reported that one Light cigarette would give the same amount of tar as one Regular cigarette. By being asked how many Light "cigarettes" would equal one Regular cigarette, participants may have felt somewhat pressured to say "more than one," but it is interesting that "I don't know" was the most common response. The wording of the key question may also have discouraged participants from using fractions of cigarettes (e.g., 1½ Lights = 1 Regular) in their responses, and the results might differ somewhat if fractional responses were encouraged.

Light and Ultra-light cigarettes do not, however, qualify as a significant harm-reduction strategy for those who want to reduce the disease risks of cigarette smoking.[2,23,24] The epidemiologic literature shows no reductions in heart disease risks from modern low-tar cigarettes compared to modern Regular cigarettes, and arguably negligible, if any, reductions in lung cancer risks for low-tar cigarettes.[25,26] In terms of reducing health risks, the evidence indicates that lower-yield cigarettes are not a useful alternative to Regular cigarettes.

The issue of the harm-reduction ineffectiveness is complicated by the concern that low-yield cigarettes are keeping smokers who would otherwise quit (or try to quit) from doing so.[27,28] Tobacco industry documents indicate that the development and promotion of low-tar brands was intended to retain health-conscious smokers in the ranks of smokers.[29] Sales figures indicate that these promotions have been successful: In 1995, 59.7% of the cigarettes sold in the United States were in the low-tar, less-than-16-mg FTC tar category.[30] To the extent that smokers believe that these cigarettes reduce tar, nicotine, and health risks, smokers appear to be motivated to switch to lower-yield cigarettes rather than quit altogether. Such beliefs could contribute to smoking initiation among young nonsmokers.

We have measured "intentions to quit smoking," but not actual quitting. For survey research, however, "intention to quit smoking" appears to be an adequate surrogate measure indicative of motivation to quit smoking. A large prospective study on a national probability sample in the United Kingdom showed that intentions to quit smoking in the next 12 months were valid predictors of actually quitting smoking in the next 12 months.[31] Godin et al. also showed that intentions to quit predicted actual quitting behavior.[32] Stages of Change Theory has also found that intentions to quit smoking strongly predict smoking cessation.[33,34] Although we would prefer to have prospective data on what would happen if smokers were informed of their mistaken beliefs about low-tar cigarettes, our study encourages further pursuit of this topic.

Note that 80% of Light cigarette smokers in the National survey and 73% of Light smokers in the State survey preferred the taste of Lights to the taste of Regulars. We do not think that there is much reason to be concerned about possible ill-effects of informing smokers that Lights are no better for them than Regular cigarettes, because (1) for those few who may switch to Regulars, the evidence indicates that Regular cigarettes are likely no worse than Lights for their health, and (2) most smokers of Lights prefer the taste and are, therefore, not motivated to switch to Regulars, even if they find there is no reduction in health risk with Lights. Informing smokers that Lights and Ultra-lights do not deliver less tar and nicotine to smokers may be a useful strategy for promoting smoking cessation: 32%

of the Light and 26% of the Ultra-light smokers in the National sample, and 27% of Light and 25% of Ultra-light smokers in the State sample, said they would be likely to quit smoking if they learned this information.

Analyses of national data have shown that "personal concern regarding the health effects of smoking" is associated with successful smoking cessation.[35] Physicians and health professionals are in a position to inform smokers of their ignorance about Light cigarettes and use the facts to help motivate smoking cessation. Regulatory action should also be encouraged to ban the misleading use of terms such as Light and Ultra-light for cigarettes[36] as has been done for foods[2]; if the terms are not banned, steps should be taken to counter-market Light and Ultra-light cigarettes[1] to help inform smokers of the risks.

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